



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Advisory Circular

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**Subject:** SPECIFICATION L-854, RADIO  
CONTROL EQUIPMENT

**Date:** 8/8/86  
Initiated by: AAS-200

**AC No:** 150/5345-49A  
Change:

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1. PURPOSE,

a. This advisory circular (**AC**) contains the specification for radio control equipment to be used for controlling airport lighting facilities.

b. This AC has been editorially updated for reprint/stock purposes only. **There were** no changes made to the content of the AC, except to update related reading material and to renumber the document to AC 150/5345-49A.

2. CANCELLATION. AC 150/5345-49, Specification L-854, Radio Control Equipment, **dated** May 20, 1977, is cancelled.

3. APPLICATION. The standards contained herein **are** recommended by the Federal Aviation Administration (**FAA**) in all applications involving airport development of **this** nature. The standards are mandatory for Federally-funded projects.

LEONARD E. MUDD  
Director, Office of Airport Standards

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SPECIFICATION **L-854**, RADIO CONTROL EQUIPMENT1. SCOPE AND CLASSIFICATION

**1.1 Scope.** - This specification **covers the equipment requirements** for radio control systems to be used for remote control of airport lighting facilities from aircraft, from a ground location, or **from both**. The basic system elements include radio receivers, radio **transmitters**, encoders, and decoders.

**1.2 Classification.** - Three types of systems **are covered by this** specification as follows:

- Type I - Air-to-ground (consists of an AM receiver and a Style A decoder)
- Type II - Ground-to-ground (consists of an **FM transmitter**, an **FM** receiver, an encoder, and a Style B decoder)
- Type III - Air-to-ground plus ground-to-ground (consists of an transmitter, two AM receivers, an encoder, a Style A decoder and a Style B decoder)

2. APPLICABLE DOCUMENTS.2.1 FAA Advisory Circular.

AC **150/5345-1** Approved Airport Lighting Equipment

2.2 Federal Communications Commission (FCC) Rules and Regulations.

Part **15** Radio Frequency Devices

Part **89** Public Safety Radio Service

(Copies of **FAA advisory** circulars **may** be obtained, free of charge, from the Department of Transportation, Subsequent Distribution Unit, **M-494.3**, Washington, DC **20591**.)

(**FCC Rules** and Regulations may be obtained from the Superintendent of Documents, Government Printing Office, Washington, **D. C. 20402**.)

### 3. REQUIREMENTS.

**3.1 General.** - Each radio-control system shall be complete in accordance with all specification requirements and shall include the basic components as listed in **1.2**. Each set of **equipment** shall be tuned and **adjusted for** operation at the frequency specified by the **purchaser**.

**3.2 Environmental Conditions.** - The equipment **shall** be designed and constructed to operate in the **following** indoor or outdoor environmental conditions as specified by the purchaser.

**3.2.1 Indoor Conditions.** - Indoor conditions **shall** be as follows:

- (a) Temperature. Temperature range of **-20° C. to +55° C.**
- (b) Humidity. Relative humidity up to **95%.**

**3.2.2 Outdoor Conditions.** Outdoor conditions shall be as follows:

- (a) Temperature. Temperature range of **-55° C. to +55° C.**
- (b) Humidity. Relative humidity up to **100%.**
- (c) Wind. Wind speeds up to **100 mph (87 knots).**
- (d) Precipitation. Exposure to rain, hail, snow, or sleet.

**3.3 Operating Requirements.** The radio control equipment will be used to operate airport lighting facilities in the following manner:

- (a) **Air-to-ground System.** The lighting facility will be operated from aircraft by clicking the microphone button a specified number of times within a **5-** second period as follows:

3 clicks - lighting system energized on the low brightness step.

5 clicks - lighting system energized on the medium brightness step.

7 clicks - lighting system energized on the **high** brightness step.

After the system is energized on a brightness step, any other brightness step may be selected by clicking the **"mike"** button the specified number of **times**. The system shall shut off **automatically 15** minutes after the last brightness step operation.

- (b) Ground-to-ground System. The ground-to-ground system is intended for operating lighting systems from an airport control tower, and the basic system can perform a maximum of 8 separate control functions. Additional control functions, in multiples of 8, can be obtained by the addition of decoder modules and associated parts.
- (c) Air-to-ground Plus Ground-to-ground System. The dual system will be used where there is a part-time airport control tower. When the control tower is in operation, the lighting facility will be controlled through the ground-to-ground unit with the air-to-ground unit deactivated. When the control tower is not in operation the lighting facility will be controlled by the air-to-ground unit. Transfer of control to and from the air-to-ground unit will be accomplished through the ground-to-ground unit.

### 3.4 Design Requirements.

3.4.1 General. The equipment shall be type accepted in accordance with Federal Communications Commission (FCC) Rules and Regulations; Part 15 for a receiver and Part 89 for a transmitter.

3.4.2 Power Input. - The equipment shall be designed to operate from 120 VAC,  $\pm 15\%$ , 60 Hz. Power for the encoder and decoders may be taken from the associated transmitter or receiver.

3.4.3 Receiver. The receiver shall conform to the following requirements:

- (a) Type. Fixed frequency superheterodynes, amplitude modulated for the Type I system and frequency modulated for the Type II system.
- (b) Frequency. 118-136 MHz band for the Type I system; 150-174 MHz and/or 450-512 MHz band for the Type II systems. A Type III system uses both Type I and Type II receivers. Frequency tolerance shall be 0.003%. The exact frequency shall be specified by the purchaser.
- (c) Sensitivity. For AM, 5 microvolts or less for a 10 dB signal plus noise-to-noise ratio  $(S+N)/N$ ; for FM, 5 microvolts or less for 20 dB of quieting. A sensitivity adjustment shall be provided.
- (d) Selectivity. Bandwidth of not less than  $\pm 9.0$  kHz from the assigned frequency at 6 dB attenuation and a bandwidth of not more than  $\pm 40$  kHz from the assigned frequency at 60 dB attenuation. Spurious signals shall be not less than 50 dB below the desired signal.
- (e) Fidelity. Output uniform within  $\pm 2$  dB from 300 Hz to 2450 Hz.
- (f) Antenna Impedance. Nominal 50 ohms unbalanced.

- (g) Output. Audio output of zero **dBm** or **more** into a **600 ohm load** with signal input of **5** microvolts modulated **30%** at **1000 Hz**. Pulses resulting from bursts of radio frequency energy shall have sufficient output to drive a Type I decoder when the input signal is 5 microvolts or more.

3.4.4 Transmitter. - **The transmitter** shall conform to the following requirements :

- (a) Type. Fixed frequency, frequency modulated.
- (b) Frequency. **150-174 MHz** and/or **450-512 MHz** band with a frequency tolerance of **0.00025%**. The exact frequency will **be** specified by the purchaser.
- (c) Power Output. Not less than 1 watt nor more than **3** watts.
- (d) Modulation. Capable of frequency deviation of **+2.5 kHz** with an input of **-10 dBm** within the frequency band of **300 Hz to 2450 Hz**.
- (e) Output Impedance. Nominal **50 ohms** unbalanced.
- (f) Input Impedance. **600 ohms**.

3.4.5 Decoders.

3.4.5.1 General. - The Style A decoder shall decode a series of electrical pulses, such as generated by clicking a transmitter microphone, to control the desired function while the Style B decoder detects a series of 3 tone burst characters per control function or address. The decoders shall not respond to signal elements of less than **50** milliseconds and shall not require signal elements of **more** than **100** milliseconds.

3.4.5.1.1 Output Relays. - Output relays shall be the plug-in type having **SPST NO** contacts rated at 3 amps, **120 V AC**, resistive and **shall** have a mechanical life of **100,000** cycles or more.

3.4.5.1.2 Output Terminals. - Output terminals shall be a screw-type barrier terminal strip rated not less than **250 V AC**.

3.4.5.1.3 Input Terminals. - When the decoder or decoders are installed in an enclosure with a receiver, the input terminals are not required. When the decoder or decoders are installed in a separate enclosure, use a screw-type barrier terminal strip of proper voltage rating and size.

**3.4.5.2 Style A Decoder.** - The decoder shall energize **1, 2, or 3** relays upon receipt of a series of electrical pulses within a S-second period, hold the relays energized for **15 minutes**, and **deenergize** the relays at the end of **the 15-minute** period. **The S-second gate period shall be started by the first pulse received.** At **the third pulse**, the first relay will be energized; at the fifth pulse, the second relay **shall** be energized; and at **the seventh pulse**, the third relay shall **be energized**. If **2 or 3 relays are** energized and a new series of pulses **are received, at the third pulse, all** relays, except the first, shall be **deenergized** and the timer shall reset for a **full 15 minutes**; at **the fifth pulse**, the second relay **shall** be energized; and at the seventh pulse, the third **relay shall be energized**. The decoder shall be designed so a simple change of connection **shall** disable the circuit that **deenergizes** the relays when pulses **are received**. The **decoder** shall have terminals for connecting a switch or relay to disable the decoder.

**3.4.5.3 Style B Decoder.** - The basic Style B decoder shall recognize 8 discrete addresses. Each address shall cause a relay to close, a relay to open, or a relay to close and another relay to open. The relay operating scheme shall be specified by the purchaser.

**3.4.5.3.1 Address.** - An address shall be a series of 3 characters that are received within a period of 3 seconds. The address may be any combination of **1, 2, or 3** individual characters such as 1-1-1, **1-4-1, 4-4-1, 1-2-4**, etc., and shall be specified by the purchaser.

**3.4.5.3.2 Characters.** - Each character shall **be** a burst of **the** paired tones shown in Table 1.

TABLE 1

Character	Frequencies	Character	Frequencies	
1	697 Hz and 1209 Hz	t	7	852 Hz and 1209 Hz
2	697 Hz and 1339 Hz	8		852 Hz and 1339 Hz
3	697 Hz and 1477 Hz	9		852 Hz and 1477 Hz
4	770 Hz and 1209 Hz	I	0	941 Hz and 1209 Hz
5	770 Hz and 1339 Hz	I	*	941 Hz and 1339 Hz
6	770 Hz and 1477 Hz	#		941 Hz and 1477 Hz

**3.4.5.3.3 Security Tone.** - The decoder shall recognize tone burst characters only if a security tone of **1633** Hz is also present.

**3.4.5.3.4 Sensitivity.** - The Style B decoder shall operate on **input** signals of **-10 dBm** or more.

### 3.4.6 Encoder.

**3.4.6.1 General.** - The basic encoder shall have a capacity of not less than **addresses**. Each address shall be represented by a single pole switch closing which will cause the encoder to generate the address that is represented by that switch. An address switch **remaining** closed or opened and **reclosed** shall have no further effect until a cancelling address is generated.

**3.4.6.2 Output.** - The encoder output shall be a security tone of **1633** Hz and the selected address. Each character of the address shall be generated for no less than **100** milliseconds and the address shall be transmitted within **1.5** seconds. **The** address shall be as specified in **3.4.5.3.1**.

**3.4.6.3 Control Panel.** - The control panel for the basic encoder shall be no larger than **4" X 8"** (**10 cm X 20 cm**) and shall have a single pole normally open momentary switch having a **minimum** rated life of **50,000** cycles for each address. Each switch shall be marked in characters of not less than **3/16-inch** and not more than **1/4-inch** in height formed by engraving, etching, or stamping. The control panel shall also have indicator lights (color to be selected by purchaser) to indicate the **status** of each address. The control panel shall be designed to be removed from the encoder and installed up to **25 feet (7.5 m)** from the encoder.

**3.4.6.4 Output Terminals.** - When Installed in an enclosure with a radio transmitter, the terminals shall be **as** required. When installed in a separate enclosure, output terminals shall be a screw-type barrier terminal strip of the proper voltage rating and size.

**3.4.7 Mean Time Between Failure (MTBF)** . - The receiver, encoder, and decoders shall be designed and constructed to provide **10,000** hours **MTBF**. The transmitter shall be designed and constructed to provide **2,000** hours **MTBF**. The manufacturer shall show his method of **determining** **MTBF**.

**3.4.8 Materials and Workmanship.** - Materials and workmanship shall be in accordance with the highest grade commercial quality and practices for equipment of this type.

**3.4.9 Nameplate.** - Each piece of equipment shall have a permanently attached nameplate having at least the **following information**:

- (a) Identification - Radio Control Equipment Type **FAA L-854**.
- (b) Unit (Receiver/Decoder, Transmitter/Encoder, etc.).
- (c) Input voltage.
- (d) Frequency range.
- (e) **Manufacturer's** name or trademark.



**3.5 Instruction Book.** - An instruction book containing the following information shall be furnished with **each** system:

(a) Complete schematic and wiring **diagrams** showing all components cross indexed to the part list. ,

(b) Complete **part list with applicable rating and** characteristics of each part **and** with manufacturer's part number.

(c) Installation instructions.

(d) Maintenance instructions.

(e) Troubleshooting **charts.**

(f) Theory of operation.

4. QUALITY ASSURANCE PROVISIONS.

**4.1 Qualification Procedures.** - Procedures for obtaining qualification approval are contained in AC 150/53345-1, Approved Airport Lighting Equipment.

**4.2 Production Tests.** - The electrical tests of **4.3.2** shall be conducted on all units. Test results shall be recorded and retained **by the** manufacturer for a period of at least two years. Production test reports shall be made available to the FM upon written request.

#### 4.3 Qualification Tests.

##### 4.3.1 Environmental Tests.

4.3.1.1 High Temperature (Outdoor Enclosure). - Install the equipment in an outdoor (weatherproof) enclosure, energize the power supply, and subject the equipment to an ambient temperature of  $55^{\circ}\text{C.} \pm 5^{\circ}$  for no less than 8 hours. Turn the equipment "on" and test for compliance with 4.3.2 within 10 minutes.

4.3.1.2 Low Temperature (Outdoor Enclosure). - Install the equipment in an outdoor enclosure, energize the power supply, and subject the equipment to an ambient temperature of  $-55^{\circ}\text{C.} \pm 5^{\circ}$  for no less than 4 hours. Turn the equipment "on" and test for compliance with 4.3.2 within 10 minutes.

4.3.1.3 Low Temperature (Indoor Enclosure). - Install the equipment in an indoor enclosure, energize the power supply, and subject the equipment to an ambient temperature of  $-20^{\circ}\text{C.} \pm 5^{\circ}$  for no less than 4 hours. Turn the equipment "on" and test for compliance with 4.3.2 within 10 minutes.

4.3.1.4 Humidity. - Install the equipment in a humidity chamber. Raise the temperature and relative humidity to  $30^{\circ}\text{C.} \pm 2^{\circ}$  and 95% relative humidity  $\pm 2\%$ . Maintain these conditions for no less than 8 hours. Turn the equipment "on" and test for compliance with 4.3.2 within 10 minutes.

4.3.2 Electrical Tests. - Test for compliance with the requirements for frequency tolerance (3.4.3 and 3.4.4), sensitivity (3.4.3 and 3.4.5.3.4), selectivity (3.4.3), input power (3.4.2), output power (3.4.4), response time (3.4.5.1), fidelity (3.4.3), and operation (3.4.5.2 and 3.4.5.3). Test reports shall show test equipment, block diagrams of test setups, measurements, calculations, and test procedures.

#### 5. PREPARATION FOR DELIVERY.

5.1 General. - Packing and packaging shall be in accordance with industry standards for equipment of this type.

#### 6. NOTES.

6.1 Options. - Purchasers using this specification will specify the following:

- (a) System Type (1.2).
- (b) Enclosure Type (3.2).
- (c) Frequency (3.4.3 and 3.4.4).
- (d) Addresses (3.4.5.3.1) for encoder and Style B decoder.
- (e) Relay operating scheme (3.4.5.2).